

ENGINE MAINTENANCE

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GENERAL

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Operation Instructions

Maintenance Steps

(1) The front figure shows the sectional diagram from which we can know the installation status of all the parts.

The part numbers are used for the working steps, at the same time non-reusable parts (denoted by mark ) and the tightening torque are marked with symbols.

Removal steps: The part numbers correspond to the numbers in the composition diagram and express the removal steps



Disassembly steps: The part numbers correspond to the numbers in the composition diagram and express the disassembly steps

Installation steps: The installation steps which are not allowed to be reversed to the removal are clarified. The installation steps which are allowed to be reversed to the removal may be omitted.

Assembly steps: The assembly steps which are not allowed to be reversed to disassembly are clarified. The installation steps which are allowed to be reversed to the removal may be omitted.




Classification of Maintenance Notices

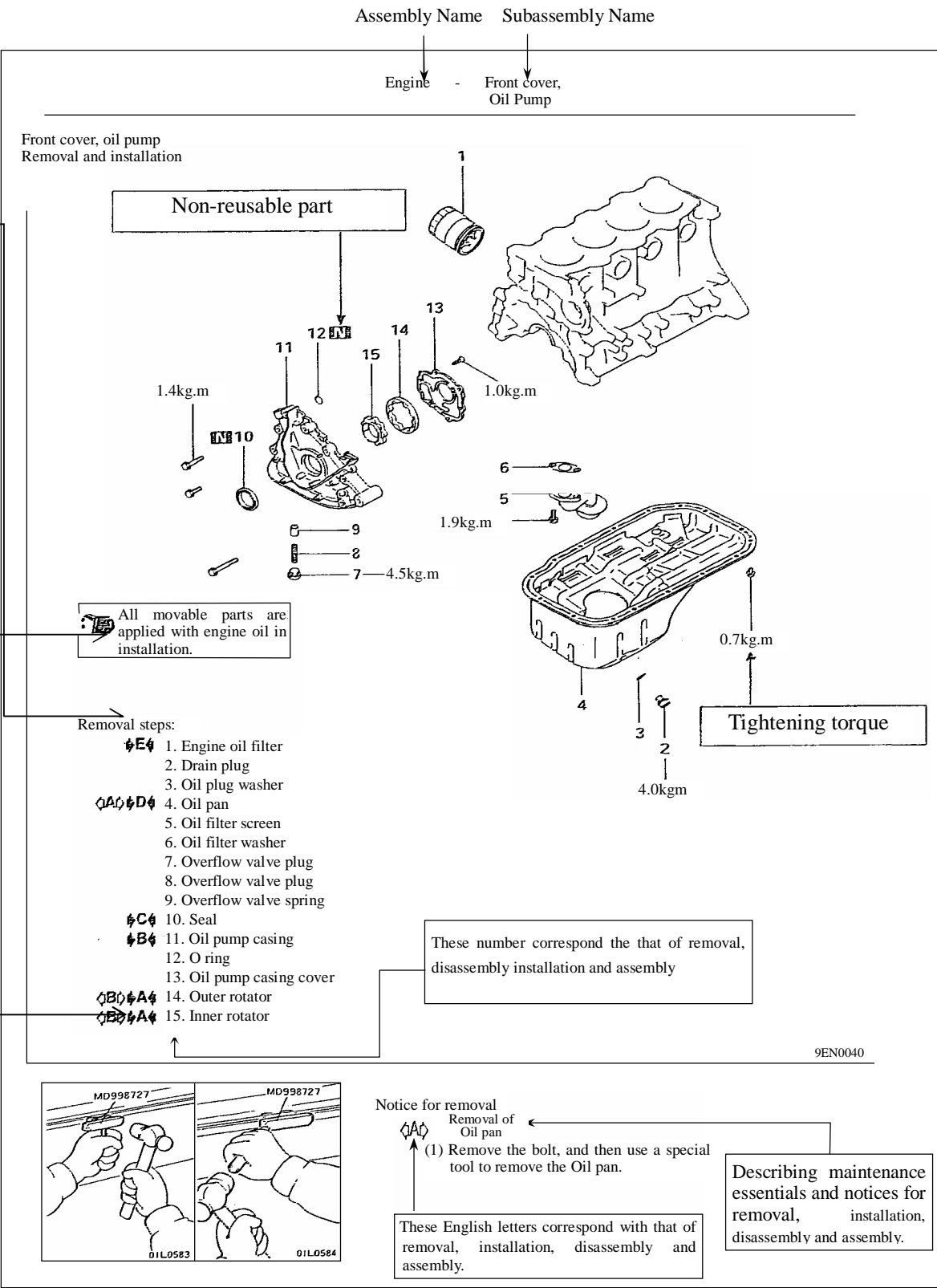
When the maintenance notice, standard value and application method of special tools are available, the maintenance notice provides the detailed descriptions concentratedly.

 : Denoting notice for removal and disassembly
 : Denoting notice for installation and assembly

Markings for filling oil, sealant and adhesive

The portions for oil filling, sealant and adhesive application or replenishing are shown in the composition diagram.

 Grease (unless otherwise specified, this is multi-purpose grease)
 Sealant or adhesive
 Engine oil or gear oil



Engine Type

Engine		
Type	Displacement	Configuration
4G64 S4 MPI	2,351 mL	4-cylinder, in-line, SOHC

Tightening Torque

The tightening torques for the general parts are listed in the table.

The tightening torques for the special parts are shown at the beginning of each group.

Tightening Torques of Bolts and Nut

Bolt Diameter	Pitch	Torque (kg.m)				
		Bolt (spring washer)			Flange Bolt	
		Head Marking 4	Head Marking 7	Head Marking 10	Head Marking 4	Head Marking 7
M6	1.0	—	0.9	1.3	—	1.1
M8	1.25	1.1	1.8	3.0	1.4	2.4
M10	1.25	2.0	3.4	6.0	3.0	5.0
M12	1.25	3.6	6.2	10.8	5.5	9.0

Tightening Torques of Conical Thread

Thread Dimension		Torque (kg.m)	
		Light Alloy	Cast Iron and Steel
NPTF	1/16	0.5 — 0.8	0.8 — 1.2
PT	1/8	0.8 — 1.2	1.5 — 2.2
PT	1/4	2.0 — 3.0	3.5 — 4.5
NPTF	1/4	2.0 — 3.0	3.5 — 4.5
PT	3/8	4.0 — 5.5	5.5 — 7.5
PT	1/2	7.0 — 10.0	12.0 — 16.0

Sealant (FIPG)

Many portions on the engine and transmission are applied with sealant. When the sealant is applied, special attentions must be paid to the amount, positions and surface status of sealant application to reach the seal goal. Insufficient application may cause leakage, and excessive application may result in blockage or narrowing of water or oil passage due to sealant overflow. Therefore, to prevent the bonding faces from leakage, application of correct amount of sealant is absolutely necessary.

The FIPG used in the engine is room temperature vulcanized (RTV), and is supplied in the form of 100 gram tube (Part No. MD970389 is for engine, and Part No. MD997740 for transmission). **RTV** is vulcanized when it is reacted with the water in the atmosphere. So it is usually used on the metal **end face**.

It is easy to disassemble the units which are assembled with sealant without adopting any special method. But in some cases, wooden hammer or **its like** is required to lightly tap the units to destroy the sealant on the bonding faces, or flat, smooth and thin sealant scraper is lightly tapped into the bonding faces. But care must be taken not to damage the bonding faces. When **engine oil pan** is removed, the special tool (MD998728) for the **oil pan** should be used

Cleaning of Seal Faces

Remove the impure objects from the seal faces by using sealant scraper or **wire brush**. Make sure that the seal surfaces are flat, smooth and free from any dirt and foreign object. Do not forget to remove the sealant from the installation holes and the threaded holes.

Essentials of Application

When FIPG is used to assemble the parts, the following caution must be paid attention to: Evenly apply the sealant on the stipulated diameter, and surround the circumference of the installation hole. Apply the sealant which is not vulcanized. Install the parts to their positions when the sealant is in wet status (with 15min). During installation, take care not apply the sealant to the place where the sealant

is not needed. After installation, wait for full vulcanization of the sealant (about 1 h is required). During this time, do not oil or water this portion or start the engine.

4G64 S4 MPI Engine

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General

Items			Specification
			4G64 S4 MPI
Configuration			In-line OHV, SOHC
Number of cylinders			4
Combustion chamber			Pent-roof combustion chamber
Total Displacement	mL		2,351
Cylinder diameter	mm		86.5
Piston Stroke	mm		100.0
Compression ratio			9.5
Valve timing	Intake valve	Open	18 ° before Top dead center
		Close	53 ° after Bottom dead center
	Exhaust valve	Open	50 ° before Bottom dead center
		Close	18 ° after Top dead center
Lubricating system			Pressure supplied and full flow filtered
Pump configuration			Gear-type
Cooling system			Water-cooled and forced cycling
Pump configuration			Outflow wheel

General Specification

1 Maintenance Standard: (Unit: mm)

Items			Standard Value	Using Limit Value
Generator Belt	Tensioner arm protrusion		12	—
	Tensioner arm compression (98~196N)		≤1	—
Cam shaft	Cam height	Intake	37.39	36.89
		Exhaust	36.83	36.33
	Shaft diameter		45.0	—
Cylinder head	Lower surface flatness		0.03	0.2
	Sum of surface grinding limit * grinding amount of cylinder block and cylinder head		—	* 0.2
	Total height		119.9—120.1	—
	Cylinder head bolt length		97.4	≤99.4
Valve	Edge thickness	Intake	1.0	0.5
		Exhaust	1.2	0.7
	Valve stem diameter		6.0	—
	Radial gap between valve stem and pipe	Intake	0.02—0.05	0.10
		Exhaust	0.03—0.07	0.15
	Banking angle		45°—45.5°	—
	Height	Intake	112.30	111.80
		Exhaust	114.11	113.61
Valve spring	Free height		51.0	50.0
	Operation pretensioning force/Operation height kg/mm		27.2/44.2	—
	Verticality		≤2°	≤4°
Valve pipe	Contact belt width		0.9—1.3	—
	Inner diameter		6.0	—
	Outer diameter		11.0	—
	Compressed height		14.0	—
	Valve stem protrusion		49.3	49.8
Oil Pump	Side gap	Driving gear	0.08—0.14	—
		Driven gear	0.06—0.12	—
Piston	Piston gap		0.02—0.04	—
Piston ring	Side gap	No.1 ring	0.02—0.06	0.1
		No.2 ring	0.02—0.06	0.1
	End gap	No.1 ring	0.25—0.35	0.8
		No.2 ring	0.40—0.55	0.8
	Oil ring		0.10—0.40	1.0
Piston pin	Outer diameter		Φ22.0	—
	Compression force kg		755—1750	—
	Compression temperature		Room temperature	—
Crankshaft	Crankshaft pin play		0.02—0.05	0.1
Connecting rod	Big end side gap		0.10—0.25	0.4
Crankshaft	Axial gap		0.05—0.18	0.25
	Main shaft diameter		Φ57	—
	Connecting rod shaft diameter		Φ45	—
	Main shaft axial gap		0.02—0.04	0.1

Items			Standard Value	Using Limit Value
Cylinder block	Upper surface flatness		0.05	0.1
	Sum of surface grinding limit * grinding amount of cylinder block and cylinder head		—	* 0.2
	Total height		290±0.1	—
	Inner diameter of cylinder hole		Φ86.50～Φ86.53	—
Cylinder block	Cylinder hole cylindricity		0. 01	—
Generator	Rotator coil resistance		3—5	—
Cylinder head	Dimensions of valve pipe installation holes (Intake valve and exhaust valve) after being enlarged twice	0.05 O.S.	11.05—11.07	
		0.25 O.S.	11.25—11.27	
		0.50 O.S.	11.50—11.52	
	Dimensions of Intake valve retainer hole after being enlarged twice	0.30 O.S.	34.435—34.455	
		0.60 O.S.	34.735—34.755	
	Dimensions of exhaust valve retainer hole after being enlarged twice	0.30 O.S.	31.935—31.955	
		0.60 O.S.	32.235—32.255	

Note:

O.S.: enlarged diameter

2. Tightening Torque

Tightened Unit	Torque (kg.m)
AC Generator and Ignition System	
AC generator fixing bolt	2.4
Support arm bolt	2.4
Pivot nut	2.3
Camshaft belt pulley bolt	2.5
Spark plug	2.5
Ignition coil bol	1.1
Timing Belt	
Timing belt front lower cover	1.1
Tensioner belt pulley bolt	4.9
Tensioner wheel arm bolt	2.2
Automatic tensioner wheel bolt	2.4
Intermediate belt pulley bolt	3.6
Tensioner belt pulley rack	4.9
Timing belt rear cover	1.1
Timing belt indicator	0.9
Oil pump belt pulley	5.5
Crankshaft belt pulley bolt	12.0
Tensioner "B"	1.9
Balance shaft belt pulley	4.6
Camshaft belt pulley bolt	9.0
Balance shaft belt pulley	4.6
Fuel System	
Throttle	1.9
Fuel distribution pipe assembly	1.2
Intake Manifold	
Engine eyebolt	1.9
Engine cooling water temperature sensor	3.0
Water outlet pipe joint bolt	2.0
Intake manifold bolt	2.0
Water temperature sensor	3.0
Exhaust Manifold	
Exhaust manifold cover bolt	1.4
Water Intake pipe joint bolt	2.4
Exhaust manifold nut (M8)	3.0
Exhaust manifold nut (M10)	5.0
Cooling water bypass pipe joint bolt	2.4
Cooling water pipe assembly bolt	1.3
Thermostat casing bolt	2.4
Water pump bolt	1.4
Rocker Arm and Camshaft	
Rocking rod cover bolt	0.4
Rocker arm and Camshaft assembly bolt	3.2
Thrust cover screw	1.9

Tightened Unit	Torque (kg.m)
Cylinder Head and Valve	
Cylinder head bolt	2.0+90°+90°
Front cover and oil pump	
Drain plug	4.5
Oil pan	0.7
Suction strainer bolt and nut	1.9
Oil pressure cock	1.0
Pressure release plug	4.5
Oil filter rack bolt	1.9
Front cover bolt	2.4
Plug	2.4
Flange bolt	3.7
Oil pump cover bolt	1.6
Oil pump cover screw	1.0
Piston and connecting rod assembly	
Connecting rod nut	2.0+90°~100°
Crankshaft, cylinder block, Flywheel and drive plate	
Flywheel bolt	13.5
Rear cover plate installation bolt	1.1
Seal cover installation bolt	1.1
Main bearing cover bolt	2.5+90°~100°

New Tightening Method - Tightening Method of Bolt in Plastic Range

A new tightening method, the tightening method in plastic range, is used for some parts in the engine. This bolt tightening method is different from the traditional one.

To tighten these bolts, strictly follow the used limits stipulated in this text.

Tightening method in plastic range is used for the following bolts:

- (1) Cylinder head bolt
- (2) Main bearing cover bolt
- (3) Connecting rod bolt


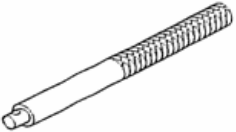
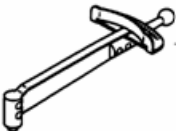

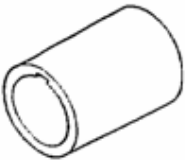
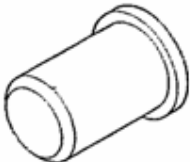

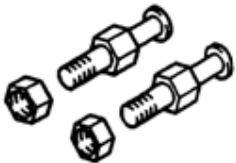

· Tightening Method:

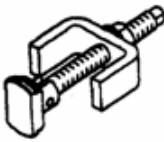

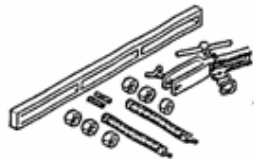
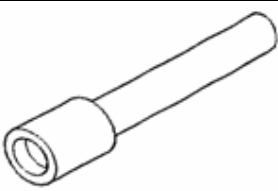
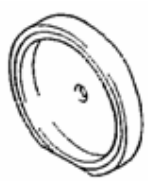

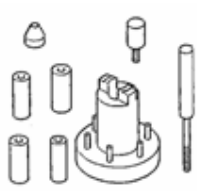
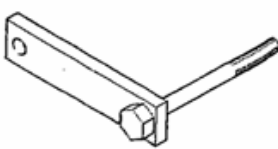
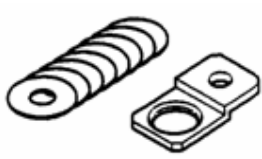
After all the bolts are tightened to the stipulated torque, retighten them further for 90 ~ 100 ° (two 90 ° for Cylinder head bolt).The tightening methods are different in the difference ranges. The method described in the text must be followed.

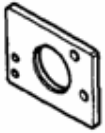
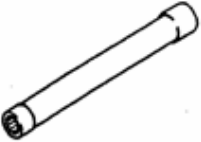


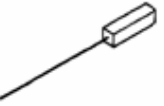

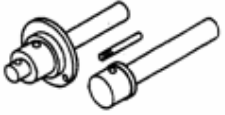

3 Sealant

Application Position	Brand Used
Water outlet pipe joint	MD970389 or equivalent
Cooling water bypass pipe joint	MD970389 or equivalent
Water thermometer unit	3M ATD No.8660 or equivalent
Oil pressure cock	3M ATD No.8660 or equivalent
Oil pan	MD970389 or equivalent
Oil Seal cover	MD970389 or equivalent
Water temperature sensor	3M NUT LOCKING No.4171 or equivalent

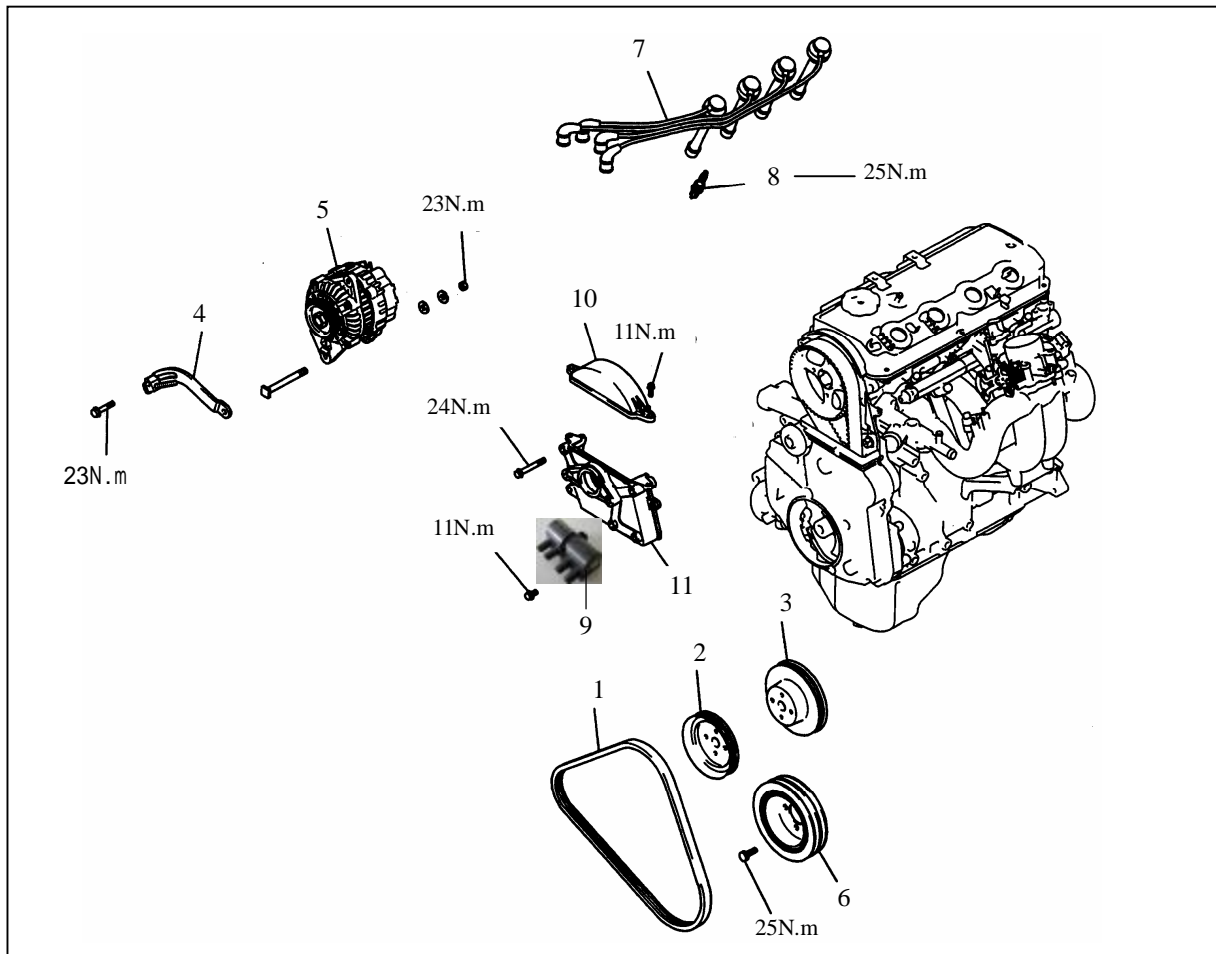
Special Service Tools

Tool	No.	Description	Purpose
	MB990767	Crankshaft pulley spanner	MD998719 used for fixing cam shaft belt
	MB990938	Handle	Used together with MD998776
	MD990685	Torque spanner	MD998783 used for tensioning timing belt
	MD998162	Thread plug spanner	Used for removal of front cover plug
	MD998285	Crankshaft front oil seal guide	MD998375 used for installation of crankshaft front oil seal
	MD998375	Crankshaft front seal installer	Installation of crankshaft front seal
	MD998713	Camshaft oil seal installer	Installation of camshaft oil seal
	MD998719	Pulley fixing pin	MB990767 used for fixing cam shaft belt pulley
	MD998727	Oil pan remover	Removal of Oil pan

Tool	No.	Description	Purpose
	MD998371	Balancing shaft bearing puller	Removal of front bearing of reverse Balancing shaft
	MD998372	Balancing shaft bearing puller	Removal of rear bearing of reverse Balancing shaft
	MD998772	Valve spring compressor	Removal of valve and related parts
	MD998774	Valve seal installer	Installation of valve seal
	MD998776	Crankshaft rear seal installer	MB990938 used for installation of crankshaft rear seal
	MD998778	Crankshaft belt pulley puller	Removal of crankshaft belt pulley
	MD998780	Piston installer	Removal and installation of piston pin
	MD998781	Flywheel Pawl	Fixation of Flywheel and drive disk
	MD998783	Thread plug spanner retainer	Used for removal and installation of front cover thread plug

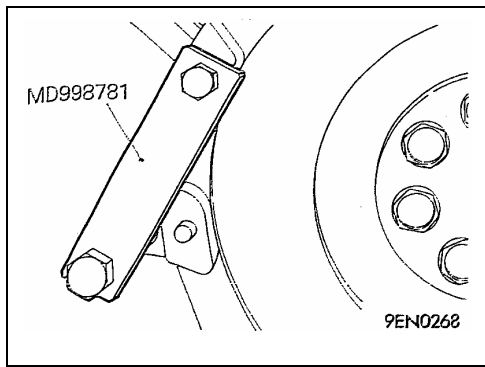
Tool	No.	Description	Purpose
	MB991603	Balancing shaft bearing puller plate	Direction limiting for removal and installation of rear bearing of reverse Balancing shaft, and used together with MD998372
	MB991654	Cylinder head bolt spanner (12)	Removal and installation of cylinder head bolt
	MD998440	Tappet Leakage-Check Tester	Hydraulic tappet leakage test
	MD998441	Hydraulic tappet bleeder	Hydraulic tappet air bleeding
	MD998442	Hydraulic tappet lever	Hydraulic tappet air bleeding
	MD998443	Hydraulic tappet retainer	Hydraulic tappet retainer used for Removal and installation of rocker arm shaft assembly
	MD998705	Balancing shaft bearing installer	Installation of front and rear bearings of reverse Balancing shaft
	MD998785	Timing belt pulley Pawl	Retaining of Balancing shaft belt pulley

AC Generator and Ignition System

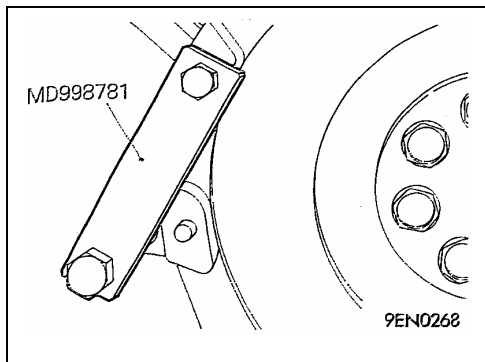


Removal steps

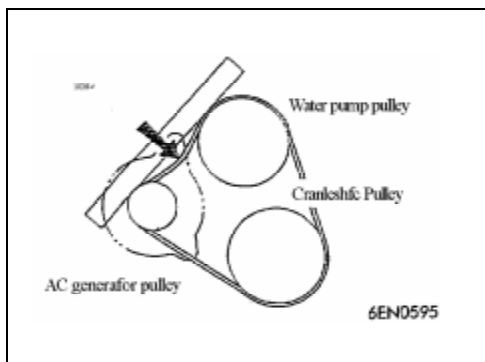
1. Drive belt
2. Water pump belt pulley
3. Power steering pump belt pulley
4. AC generator support
5. AC Generator
6. Crankshaft belt pulley
7. Spark plug cable
8. Spark plug
9. Ignition coil
10. Front upper cover of timing belt
11. Ignition coil holder

**Notice for Removal****Removal of Crankshaft Bolt**

- (1) Hold the **Flywheel** with the special tool.
- (2) Remove the crankshaft bolt.

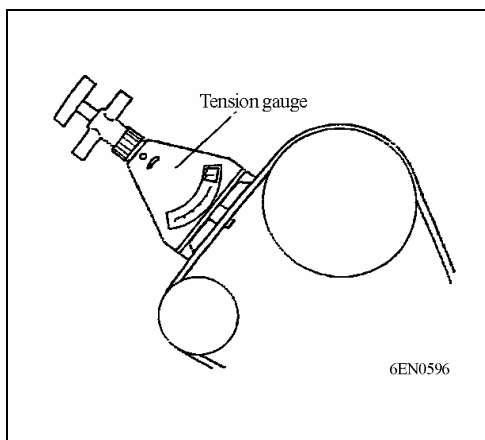
**Notice for Installation****Installation of Crankshaft Bolt**

- (1) Hold the Flywheel with the special tool.
- (2) Install the crankshaft bolt.

**Adjust the drive belt tension to its standard value with help of flexibility indicator or tensimeter.****Standard Value**

New belt 5.5—7.5mm

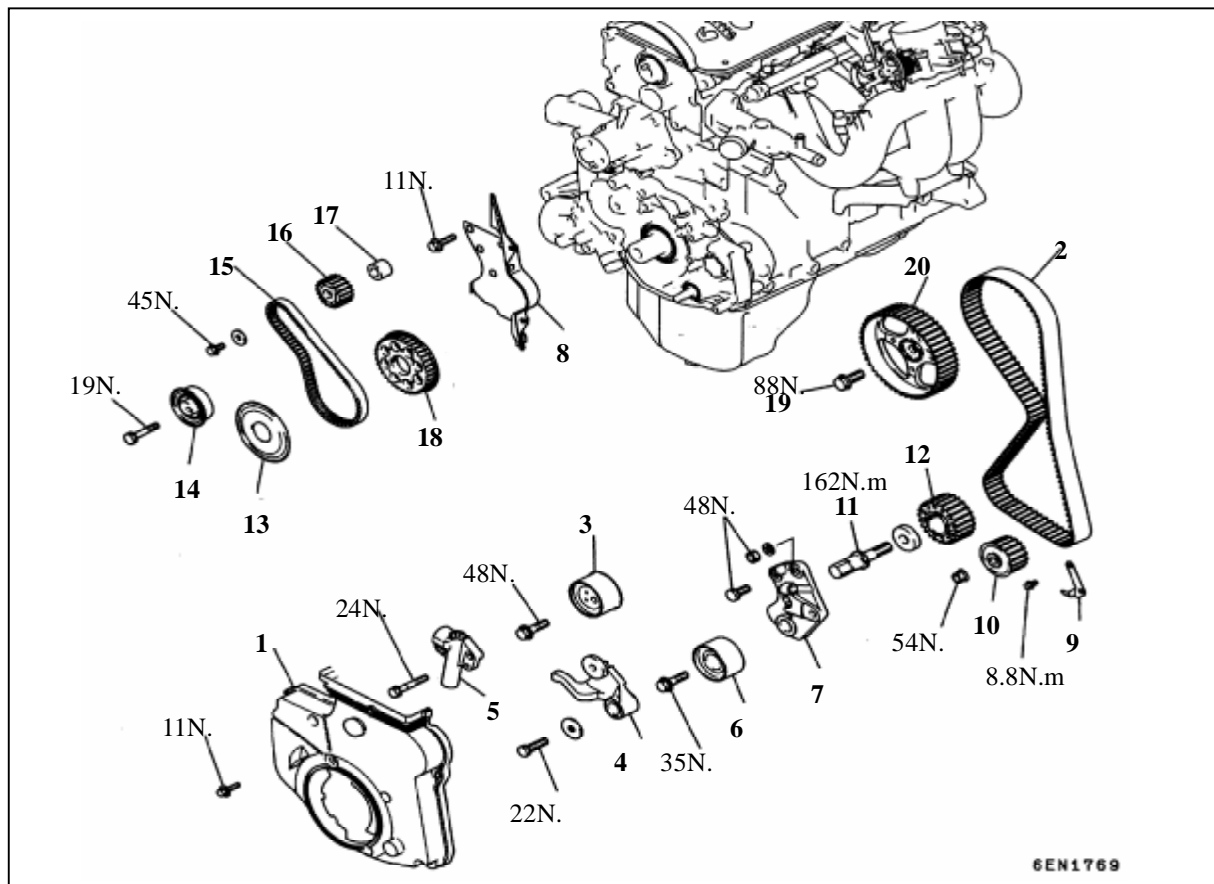
Used Belt 7.5—8.5mm

**Standard Value**

New belt 50—70N

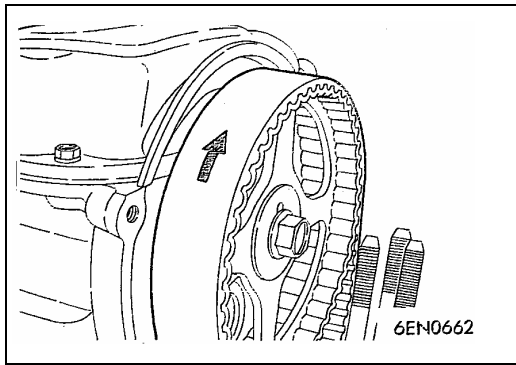
Used Belt 35—45N

Timing Belt



Removal steps

1. Timing belt front lower cover
2. Timing belt
3. Tensioner belt pulley
4. Tensioner arm
5. Automatic tensioner
6. Intermediate belt pulley bolt
7. Tensioner belt pulley rack
8. Timing belt rear cover
9. Timing belt indicator
10. Oil pump belt pulley
11. Crankshaft bolt
12. Crankshaft belt pulley
13. Flange
14. Tensioner B
15. Timing belt
16. Balancing shaft belt pulley
17. Bush
18. Crankshaft belt pulley
19. Cam shaft belt pulley bolt
20. Crankshaft belt pulley



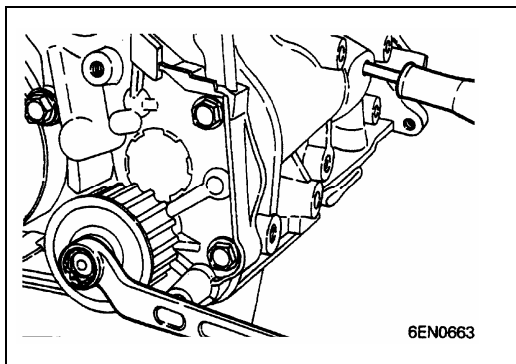
Notice for Removal

Removal of Timing Belt

- (1) Note down the rotary direction of the belt for correct installation.

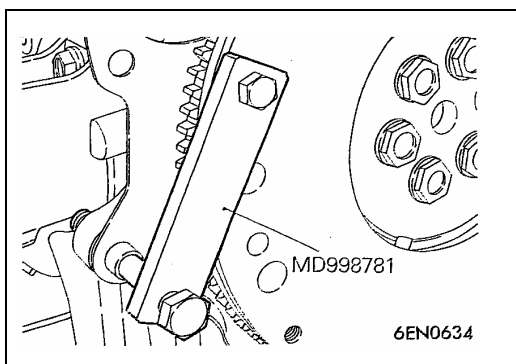
Note: • Water or grease attached to the belt may dramatically shorten the service life of the belt. Therefore, after removal, pay special attention to prevent water or grease from attaching and polluting the belt, pulley, tensioner, and etc. Do not clean these parts. Replace with new ones if seriously polluted.

- If any water or oil or grease is found on these parts, check the front cover seal, cam shaft seal and water pump for leakage.



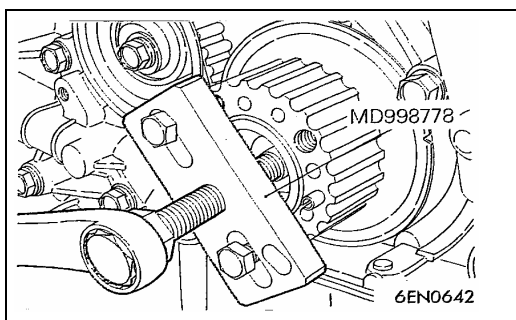
Removal of oil pump belt pulley

- (1) Remove the thread plug on the side of cylinder block.
- (2) Insert a cross-head screwdriver in a diameter of 8mm to fix the left **Balancing shaft**.
- (3) Remove the nut from the oil pump belt pulley.
- (4) Remove the oil pump belt pulley.



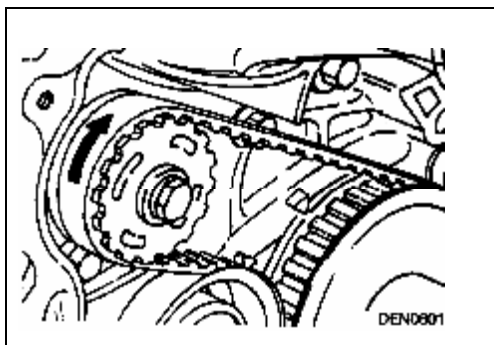
Removal of Crankshaft Bolt

- (1) Fix the **Flywheel** with the special tool.
- (2) Remove the crankshaft bolt. Support the **Flywheel** with the special tool.



Removal of Crankshaft Belt Pulley

- (1) If removal is not easy due to adhesion, use special tool.

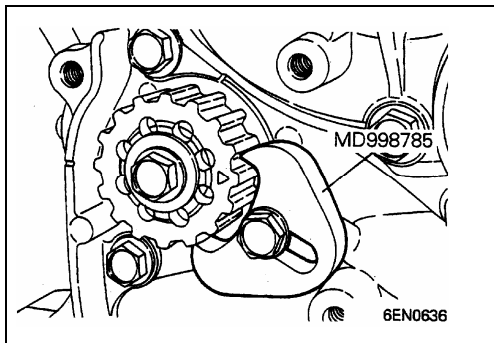


Removal of Timing Belt B

- (1) Note down the rotary direction of the belt for correct installation.

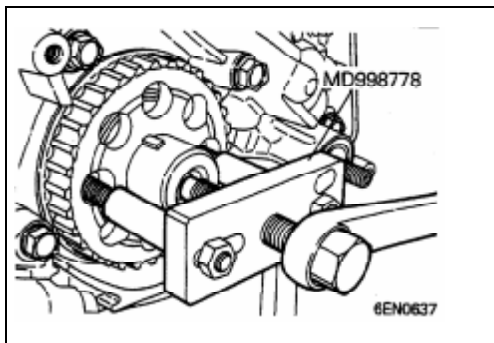
Note:

- Water or oil or grease attached to the belt may dramatically shorten the service life of the belt. Therefore, after removal, pay special attention to prevent water or oil or grease from attaching and polluting the belt, pulley, tensioner, and etc. Do not clean these parts. Replace with new ones if seriously polluted.
- If any water or oil or grease is found on these parts, check the front cover seal, cam shaft seal and water pump for leakage.



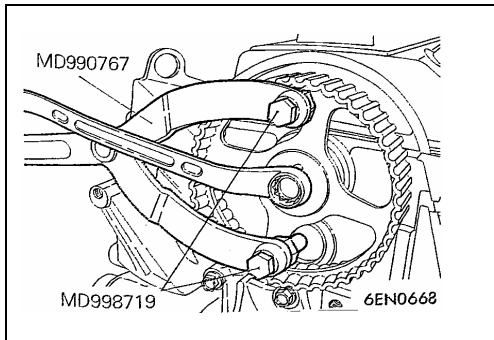
Removal of Balancing shaft Belt Pulley

- (1) Fix the Balancing shaft belt pulley by using the tool as shown in the Fig.
- (2) Remove Balancing shaft belt pulley.



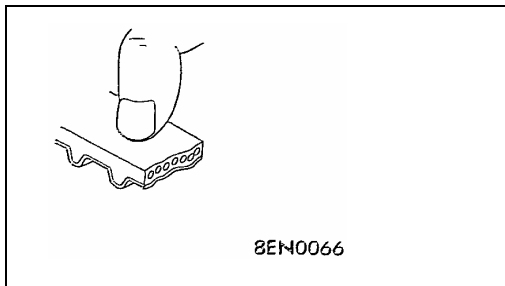
Removal of Crankshaft Belt Pulley B

- (1) If removal is not easy due to adhesion, use special tool.



Removal of Crankshaft Belt Pulley Bolt

- (1) Fix the cam shaft Timing Belt pulley by using the special tool.
- (2) Remove the crankshaft belt pulley bolt

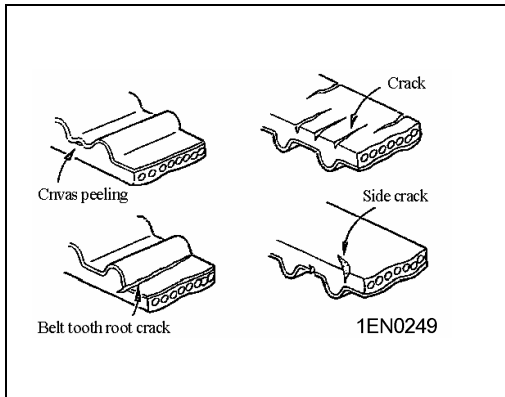


INSPECTION

1 Timing Belt

Carefully check all the parts of the belt, and replace with new one if any of the following damages is found:

(1) The back rubber is aged and reflective, and has no signs after being scratched by finger nail and no elasticity.

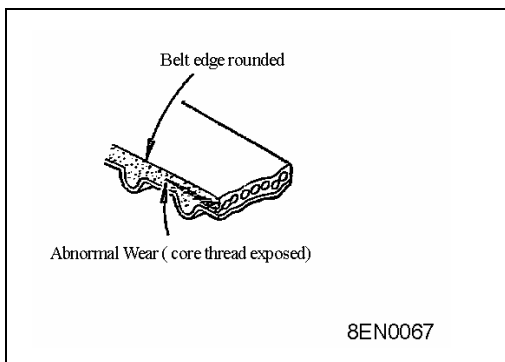


(2) Back rubber is cracked.

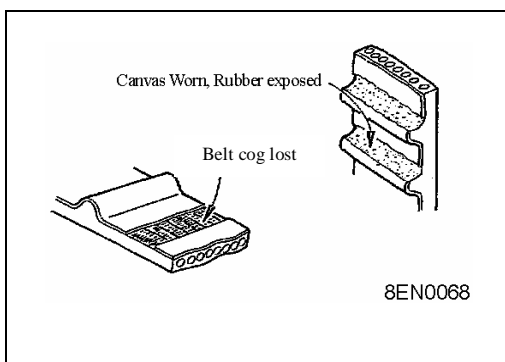
(3) Canvas is cracked and stripped.

(4) Belt cog bottom is cracked.

(5) Belt side is cracked.

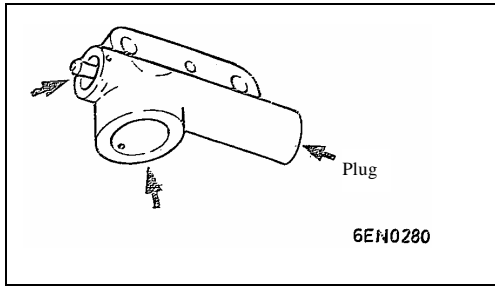


(6) Belt side is abnormally worn. It means that the belt side is normal if it is so tidy and uniform as cut with sharp knife.



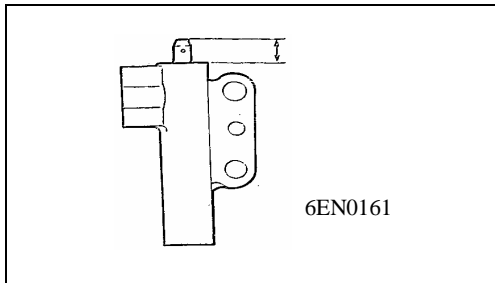
(7) Belt cog is abnormally worn.

(8) Cog is lost.



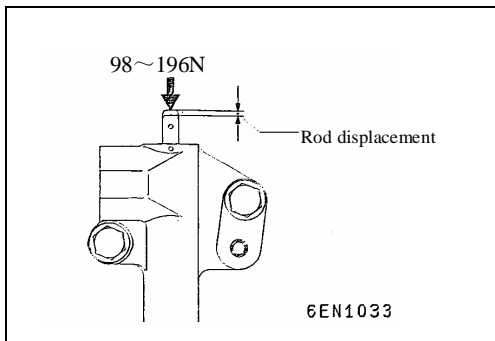
2 Automatic Tensioner

- (1) Check the automatic tensioner for leakage, and replace with new one if necessary.
- (2) Check the rod end for wear or damage, and replace with new one if necessary.



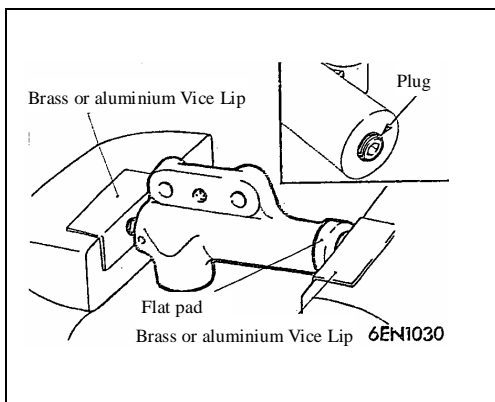
- (3) Measure the protrusion of the rod. Replace the automatic tensioner with new one if not satisfactory.

Standard value: 12mm



- (4) Press down the rod with a force of 98~196N, and measure the displacement of the rod at the same time.
- (5) Replace the automatic tensioner if the displacement of the rod is more than 1mm less than the value measured in Step (3).

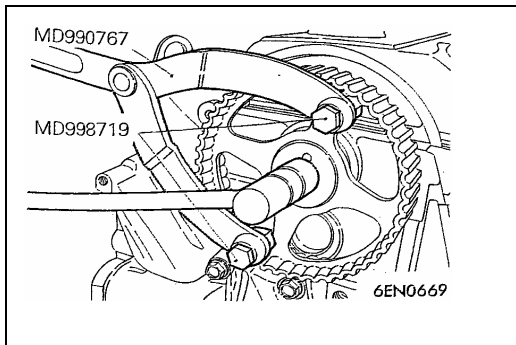
Standard value: ≤ 1mm



- (6) Firmly fix the automatic tensioner by using a vice with soft mouth.

Caution:

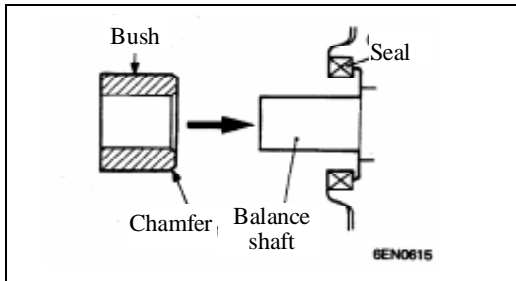
- Since there is a protrusion of the thread plug at the bottom end of the automatic tensioner, insert a flat padding plate between the vice and the thread plug to prevent the two from direct contact.
- (7) Rotate the vice handle to push the rod of automatic tensioner inward. Replace the automatic tensioner with new one if the pushing is very easy. Some resistance should be felt when the rod is pushed inward.



Notice for Installation

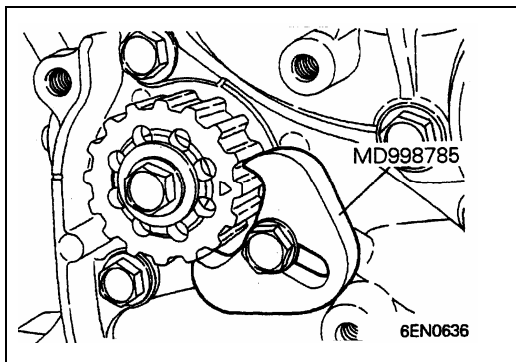
Tightening of Crankshaft Belt Pulley Bolt

- (1) Fix the cam shaft Timing Belt pulley by using the special tool.
- (2) Tighten the crankshaft belt pulley bolt to the stipulated torque.



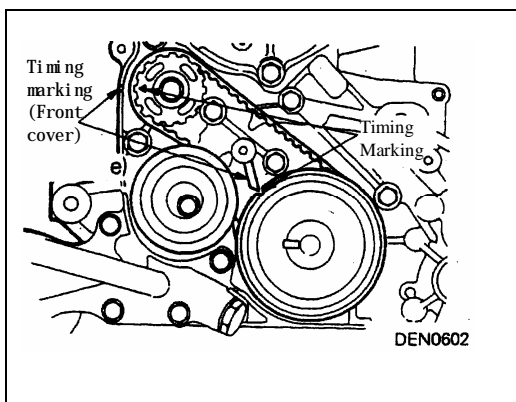
Installation of Bush

- (1) When installing the bush, place the side with chamfer to face the seal.



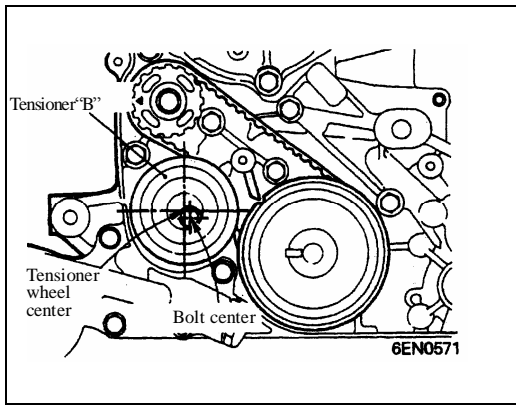
Installation of **Balancing shaft** Belt Pulley

- (1) Fix the **Balancing shaft** belt pulley by using the tool as shown in the Fig.
- (2) Tighten the bolt to the stipulated torque.

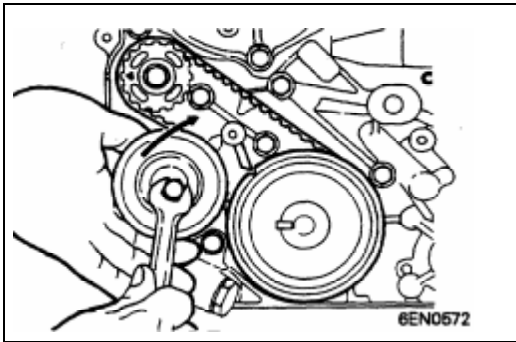


Installation of Timing Belt B

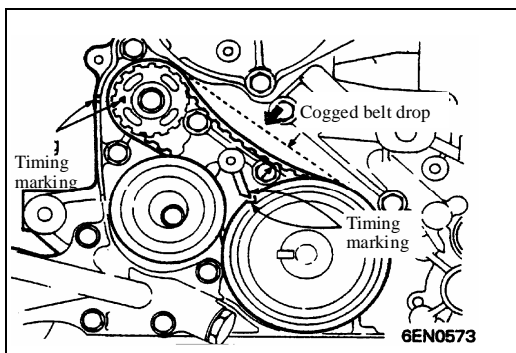
- (1) Align the markings on the crankshaft belt pulley and the **Balancing shaft** belt pulley to the markings on the front cover.
- (2) Install the Timing Belt on the crankshaft belt pulley and the **Balancing shaft** belt pulley. It is not allowed that there is no looseness on the side of tension.



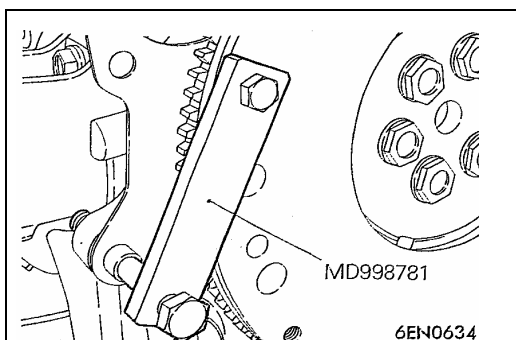
- (3) Make sure that the centers of the tensioner pulley and the bolt are positioned as shown in the Fig.



- (4) Apply a finger force to the side of Timing Belt tensioner, and at the same time move tensioner B in the direction of the arrow. At this time, tighten the bolt to fix tensioner B. Pay attention not to rotate the shaft together with the belt pulley to overtension the belt during tightening the bolt.

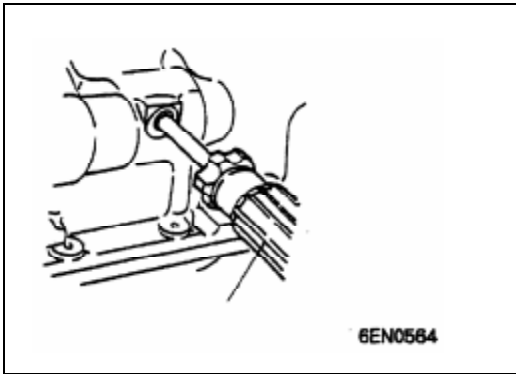


- (5) Make sure that the markings on the belt and front cover are aligning each other.
- (6) Press the central portion of the Timing Belt B on the side of the tensioner with index finger, and check that the depression of the belt is 5~7mm.



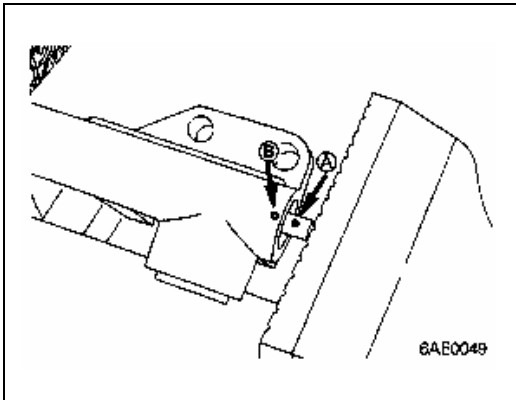
Installation of Crankshaft Bolt

- (1) Hold the **Flywheel** with the special tool.
- (2) Install the crankshaft bolt.



Installation of Oil Pump Belt Pulley.

- (1) Insert a cross-head screwdriver into the plug hole on the left side of the cylinder block to resist the rotation of the **Balancing shaft**.
- (2) Install the oil pump belt pulley.
- (3) Apply oil on the mating faces of the nut and the bearing.
- (4) Tighten the nut to the stipulated torque.

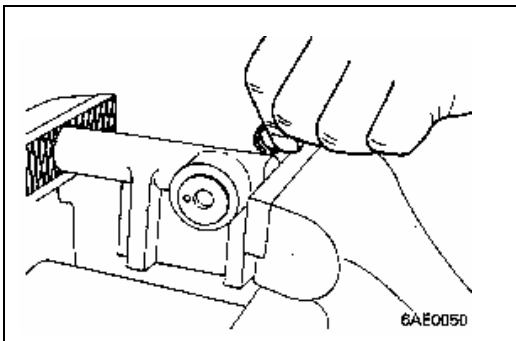


Installation of Automatic Tensioner

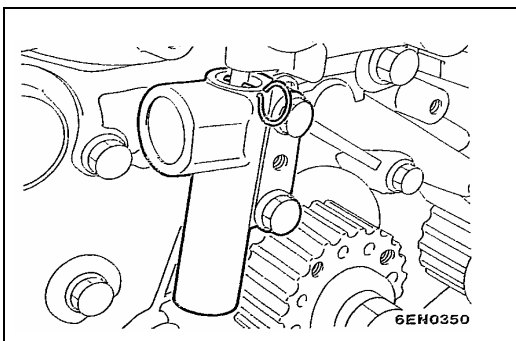
- (1) If the automatic tensioner rod is at extended position, retract it in the following steps:
- (2) Firmly fix the automatic tensioner by using a vice with soft mouth.

Caution:

- Since there is a protrusion of the thread plug at the bottom end of the automatic tensioner, insert a flat padding plate between the vice and the thread plug to prevent the two from direct contact.



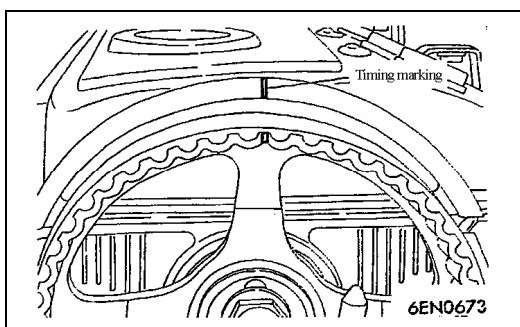
- (3) Slowly push the rod inward by using the vice until hole A in the rod is aligned with hole R in the oil cylinder.



- (4) Insert a steel wire (in diameter of 1.4mm) into the aligned holes.
- (5) Remove the automatic tensioner by using a vice.
- (6) Install the automatic tensioner on the front cover, and tighten the bolt to the stipulated torque

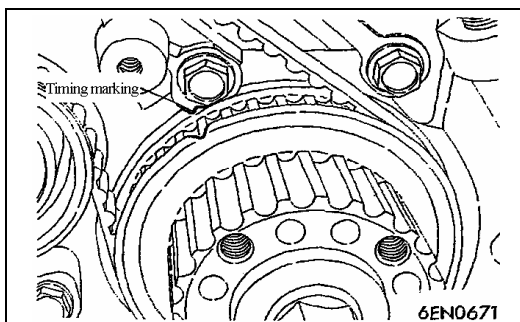
Caution:

- Leave the steel wire in the automatic tensioner.

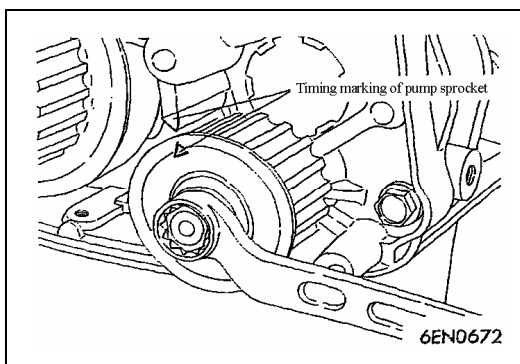


Installation of Timing Belt

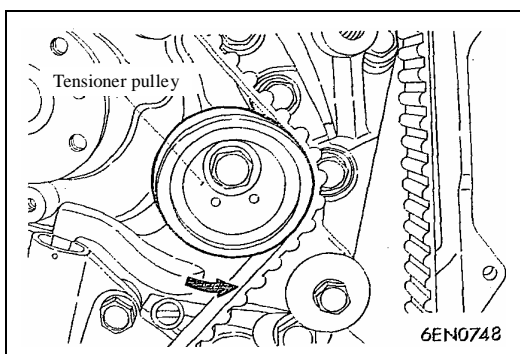
- (1) Make sure that the Timing Belt tensioner is well installed.
- (2) Align the marking on cam shaft belt pulley to the marking on the cylinder head.



- (3) Align the marking on the crankshaft belt pulley to the marking on the front cover.

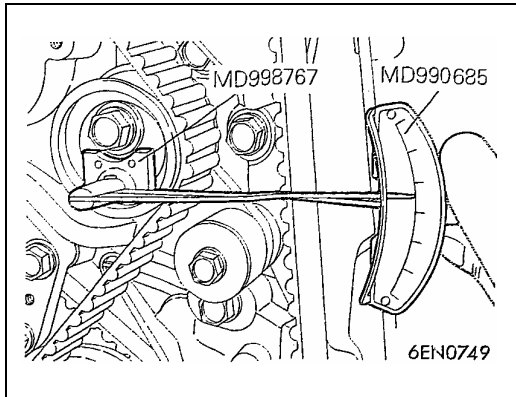


- (4) Align the marking on the oil pump belt pulley to its corresponding marking.
- (5) Remove the plug from the cylinder block, and then insert a cross-head screwdriver (in diameter of 8mm) into the hole. Insertion of above 60mm means the alignment of the timing markings. If the insertion is not over 20~25mm, rotate the oil pump belt pulley one turn, and then align the timing markings. Recheck that the screwdriver is inserted by over 60mm. Keep the screwdriver in the inserted position until the installation of the belt is completed.



- (6) Connect the Timing Belt in turn onto the crankshaft belt pulley, intermediate wheel, cam shaft belt pulley and tensioner belt pulley.
- (7) Lift the tensioner belt pulley in the direction of arrow, and then tighten the central bolt.

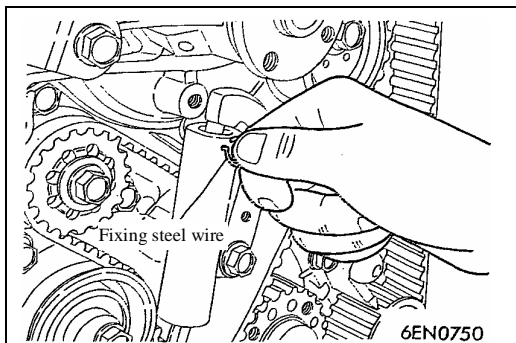
- (8) Check that all the timing markings are in a straight line.
- (9) Remove the screwdriver inserted in Step (5), and install the plug.
- (10) Counterclockwise rotate the crankshaft a quarter turn. Then clockwise rotate until all the timing markings are realigned.
- (11) Install the sleeve spanner and torque spanner of the special tools onto the tensioner belt pulley, and then loosen the central bolt of the tensioner belt pulley.



Note:

If special tools are not used, general spanners, which can be used to measure the torque of 0~0.3 kg.m.

- (12) Tighten to the torque of 0.26~0.27kg.m by using torque spanner.
- (13) On the one hand, retain the tensioner belt pulley by using special tools and torque spanners, and on the other hand, tighten the central bolt to its standard value.

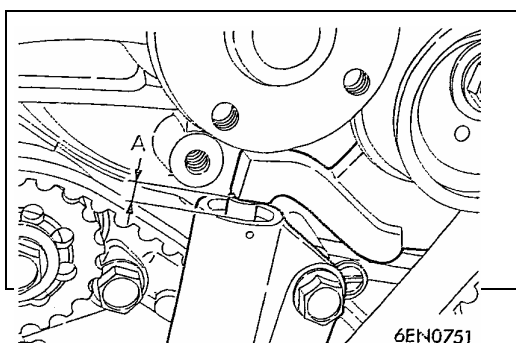


- (14) Clockwise rotate the crankshaft two turns, and leave it for about 15min. Then check the automatic tensioner fixing steel wire for free slide.

Note:

If the steel wire does not slide freely, repeat above Step (10) until the steel wire slides freely.

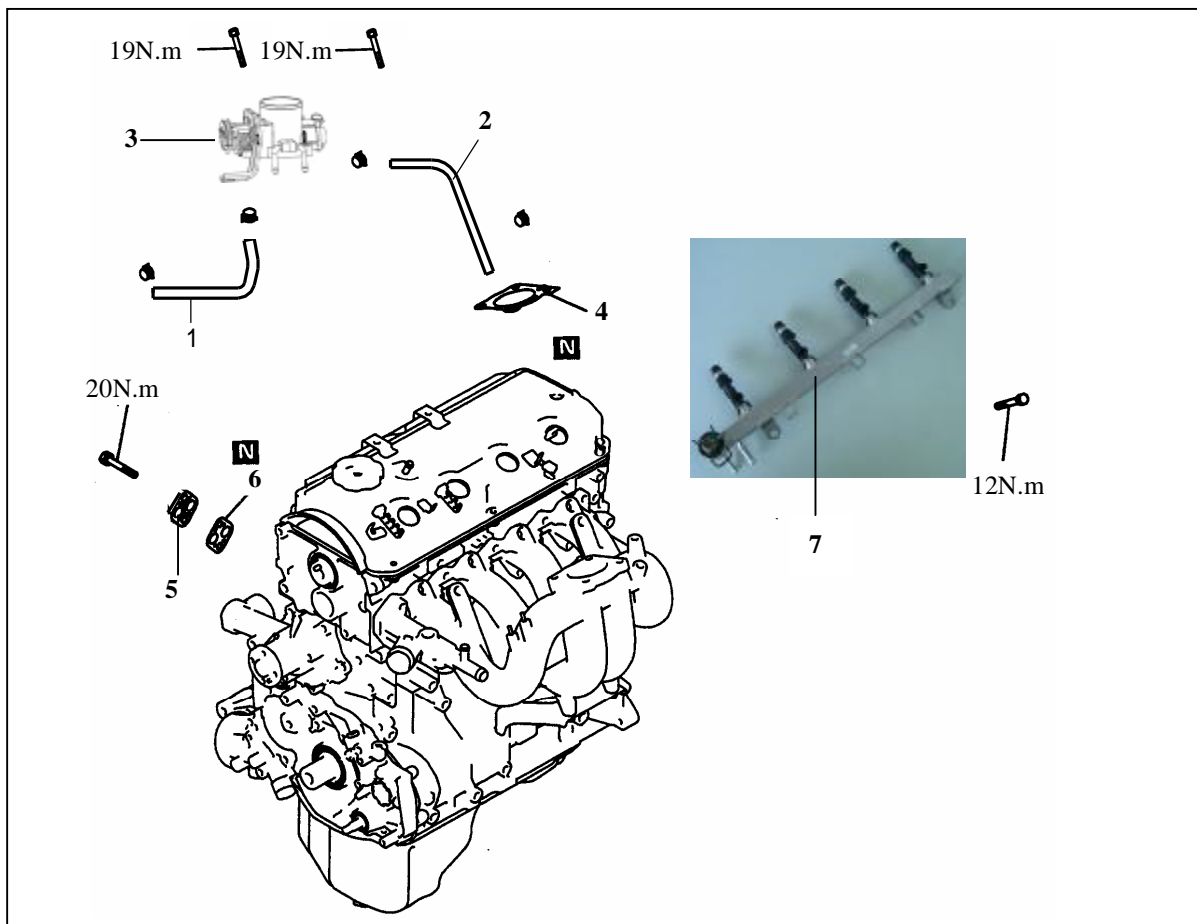
- (15) Remove the automatic tensioner fixing steel wire.



- (16) Measure distance "A" (between the tensioner arm and the automatic tensioner body).

Standard value: 3.8—4.5mm

Fuel System



Removal Steps

1. Water pipe
2. Water pipe
3. Throttle body
4. Pad
5. Cover
6. Pad
7. Fuel distribution pipe assembly

Notice for Installation

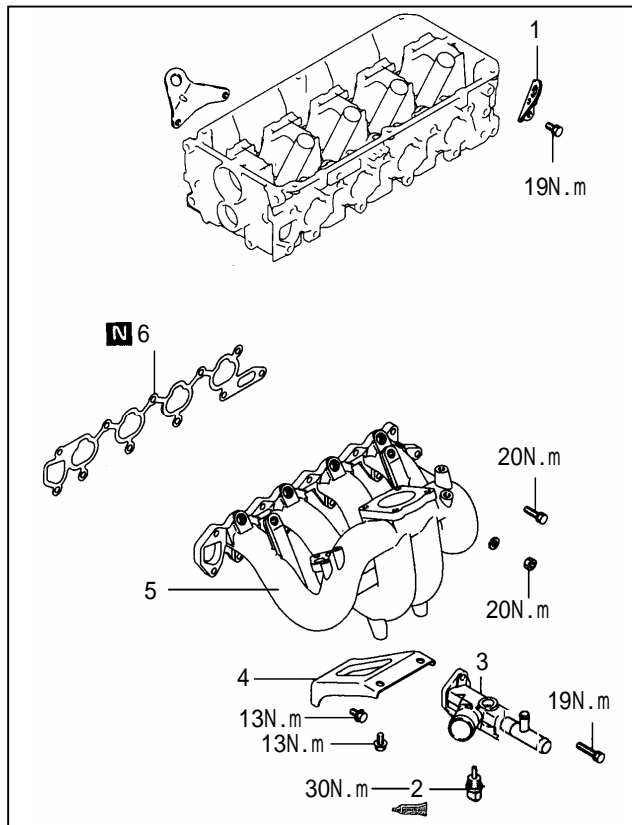
Installation of Fuel Distribution Pipe Assembly

Before installation of fuel distribution pipe assembly, carefully lubricate the mating surface or O ring on the manifold with mineral oil, and align the central line of the injector to that of the installation hole, and insert it into the Intake manifold. Finally tighten the bolt to the stipulated torque.

(1) Mineral oil : ISO Grade 10 (10cs (centistokes) at 40 °)

(2) Avoid the oil, when used, from entering the inside of injector.

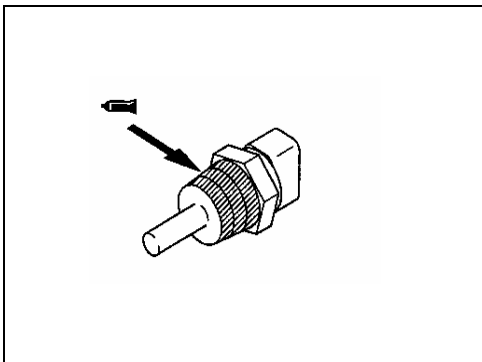
Intake Manifold



Removal Steps

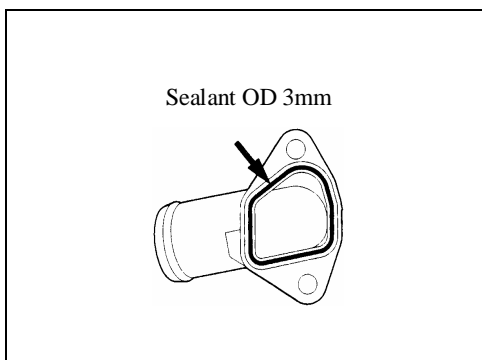
1. Engine lift ring
2. Engine water temperature sensor
3. Water outlet joint
4. Inlet manifold rack
5. Inlet manifold
6. Inlet manifold pad

Notice for Installation



Application of Sealant of Engine Water Temperature Sensor

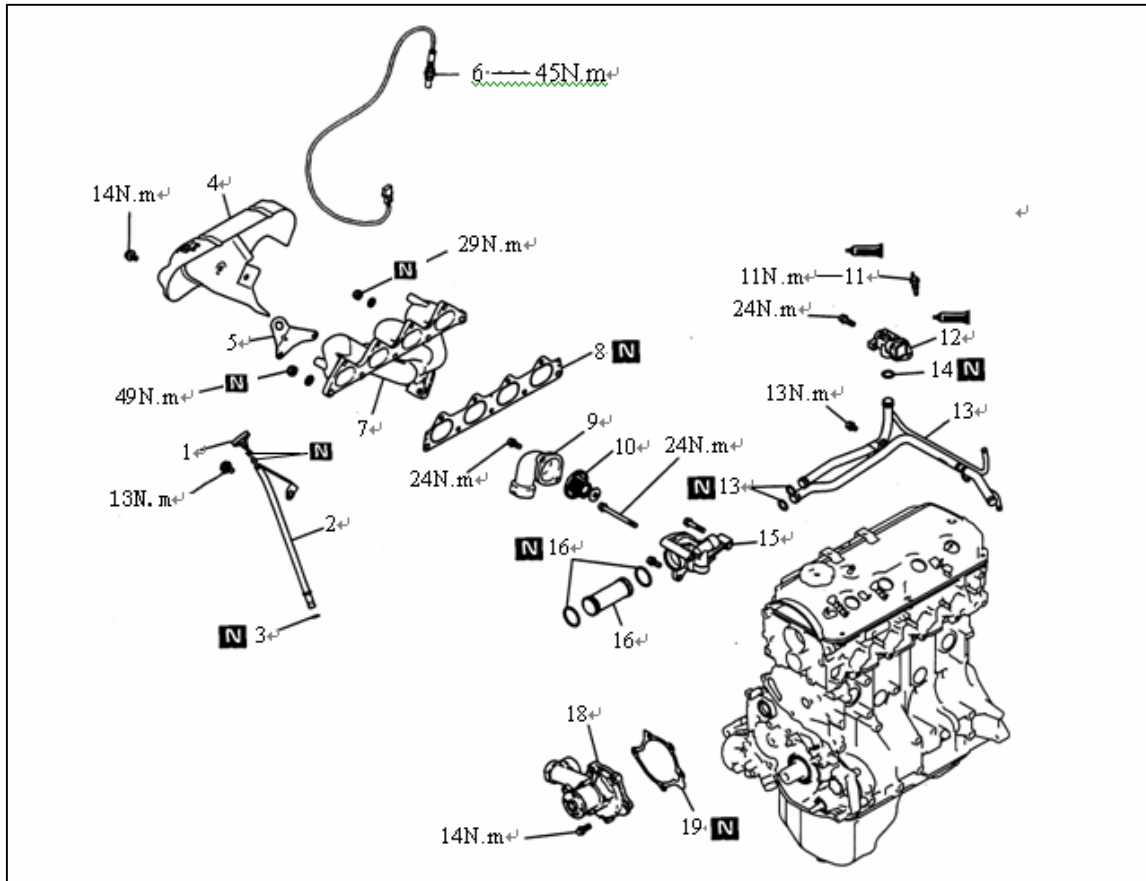
Sealant specification: 3 M nut lock part NO.4171 or equivalent



Application of Sealant of Water Outlet Joint

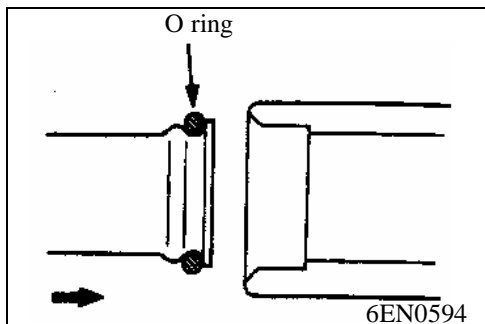
Sealant specification: Mitsubishi Brand part NO.MD970389 or equivalent

Exhaust Manifold and Water Pump



Removal Steps

1. Oil dip stick
2. Oil dip stick pipe
3. Ring
4. Thermal baffle
5. Engine lift ring
6. Oxygen sensor
7. Exhaust manifold
8. Exhaust manifold pad
9. Water outlet joint
10. Thermostat
11. Water temperature induction plug
12. Water bypass pipe joint
13. Water pipe assembly
14. Water pipe O ring
15. Thermostat casing
16. Water inlet pipe
17. O ring
18. Water pump
19. Water pump pad

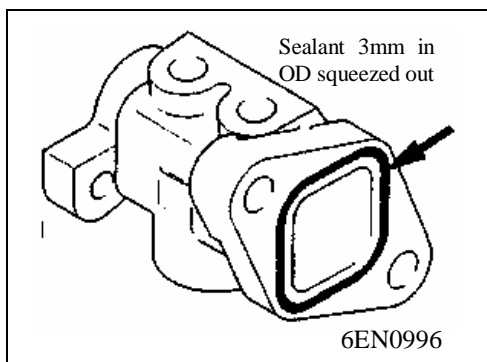


Notice for Installation

Installation of O Ring

(1) Moist the O ring with water for convenience of assembly.

Caution: O ring should be free from oil or grease.



Installation of Water Bypass Pipe Joint

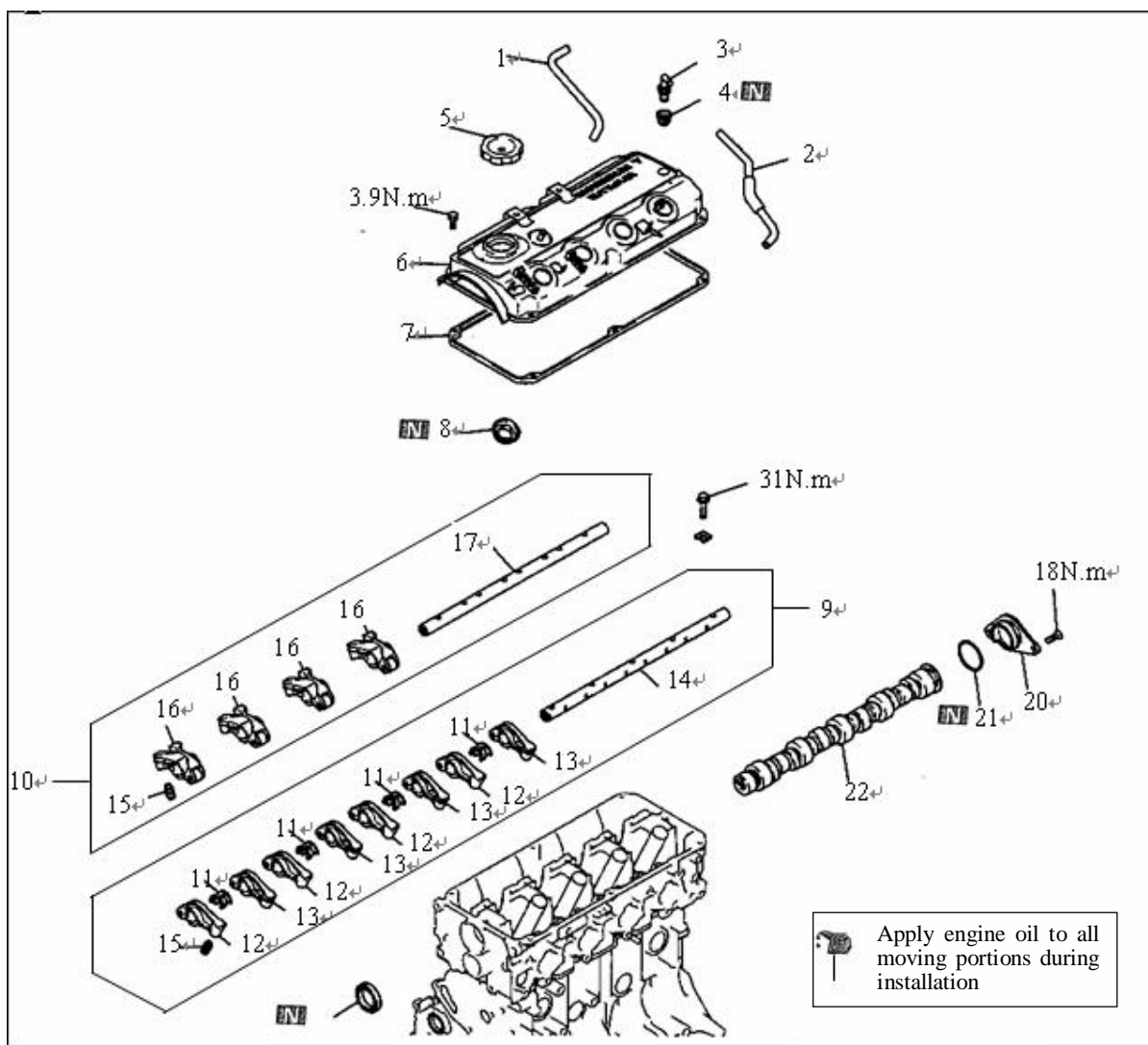
Sealant specification:

Sealant specification: Mitsubishi Brand part NO.MD970389 or equivalent

Note:

- (1) Quickly install the water bypass pipe joint when the sealant is still wet (within 15min).
- (2) Do not add any oil to the sealing portion within about 1h after installation.

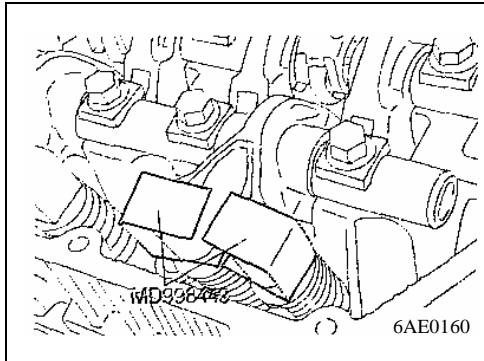
Rocker Arm and Cam Shaft



Removal Steps

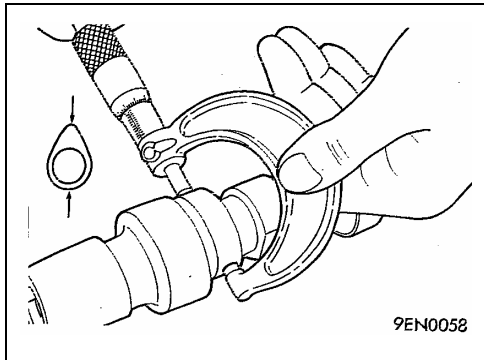
1. Vent hose
2. PCV hose
3. PCV valve
4. PCV valve pad
5. Oil filler cap
6. Rocker arm cover
7. Rocker arm cover pad
8. Oil seal
9. Rocker arm and rocker arm shaft
10. Rocker arm and rocker arm shaft

- 11. Rocker arm shaft spring
- 12. Rocker arm A
- 13. Rocker arm B
- 14. Rocker arm shaft (Intake side)
- 15. Hydraulic tappet
- 16. Rocker arm C
- 17. Rocker arm shaft (exhaust side)
- 18. Hydraulic tappet
- 19. Oil Seal
- 20. Thrust cover
- 21. O ring
- 22. Cam shaft



Notice for Removal

- (1) Before removal of the Rocker arm and rocker arm shaft assembly, use the special tool for installation as shown in the Fig. to prevent Hydraulic tappet from falling.



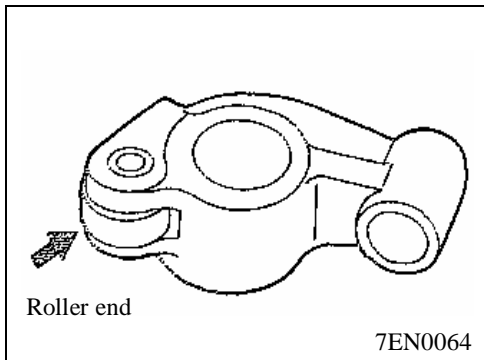
INSPECTION

Cam shaft

- (1) Measure cam height.

For standard value and used limit value, see the following table:

	Standard Value	Used Limit Value
Intake	37.39	36.89
Exhaust	36.83	36.33



Rocker Arm

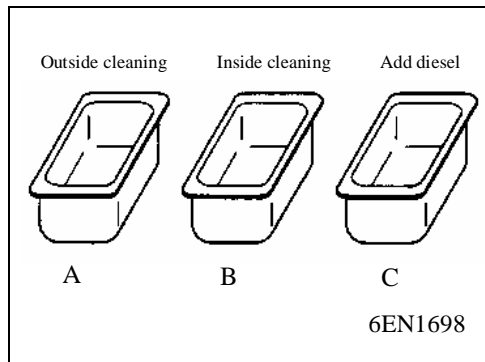
- (1) Check the roller surface for any signs of damage or seize and replace the rocker arm, if any.
- (2) Check the roller for smooth rotation. Replace the rocker arm if the rotation is not smooth or loose.
- (3) Check the inner diameter. Replace the rocker arm if there is any damage or seize.

Hydraulic Tappet

Caution:

- (1) Hydraulic tappet is a precision part. Its surface should be free from any dust, foreign objects, etc.
- (2) Do not remove the hydraulic tappet.

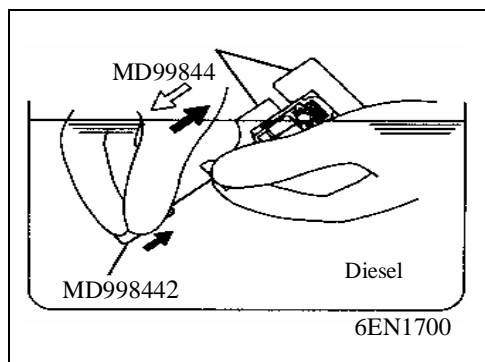
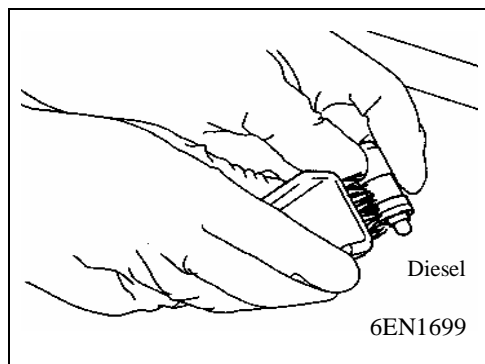
- (3) Clean the hydraulic tappet with clean diesel oil.



- (1) Prepare 3 containers and about 5L of diesel oil. Pour adequate diesel oil to each container to immerse the vertically positioned hydraulic tappet, and then proceed the following steps:

- (2) Put the hydraulic tappet into container A, and clean its surface.

Caution: Remove the hard cohesive with nylon brush.

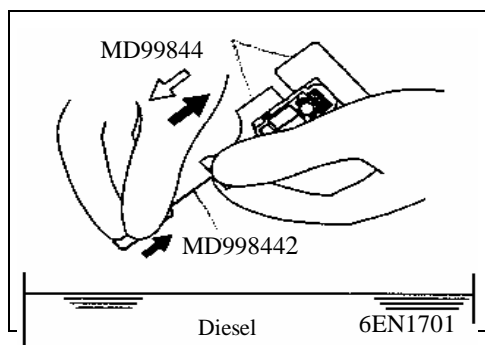


- (3) Install special tool MD998441 on the hydraulic tappet.

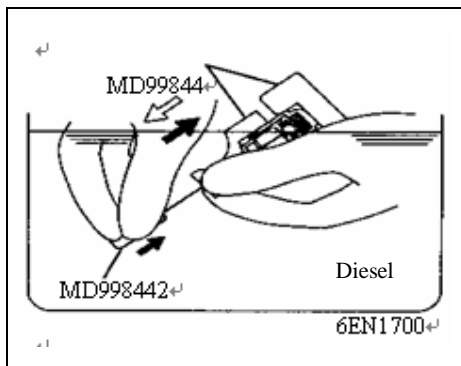
- (4) Gently push the internal steel ball by using special tool MD998442, and move the plunger for 5 to 10 strokes until it slides smoothly. Moreover, eliminate the plunger slide resistance and remove the dirty oil.

Caution:

- The steel ball spring is very soft, so do not use too much force in order to prevent the hydraulic tappet from damage when air leakage wire is used to push the steel ball.
- If the plunger slides with resistance or blocking or mechanical device is abnormal, replace the hydraulic tappet.



- (5) Take out the hydraulic tappet from the container. Then gently push the steel ball and move the plunger to remove the diesel oil from the pressure cavity.

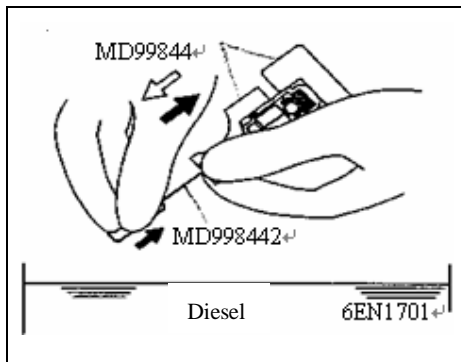


(6) Install special tool MD998441 on the hydraulic tappet.

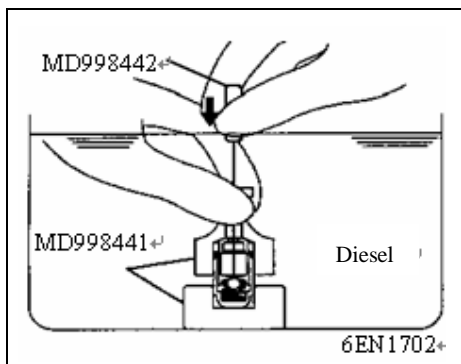
(7) Put the hydraulic tappet into container B. Gently push the internal steel ball by using special tool MD998442, and move the plunger for 5 to 10 strokes until it slides smoothly. This operation may clean the pressure cavity of the hydraulic tappet.

Caution:

The steel ball spring is very soft, so do not use too much force in order to prevent the hydraulic tappet from damage when air leakage wire is used to push the steel ball.



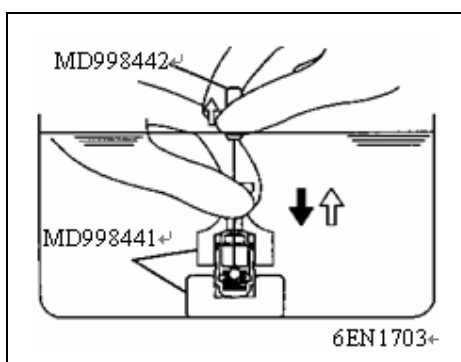
(8) Take out the hydraulic tappet from the container. Then gently push the steel ball and move the plunger to remove the diesel oil from the pressure cavity.



(9) Put the hydraulic tappet into container C. Then gently push the internal steel ball by using special tools MD998442.

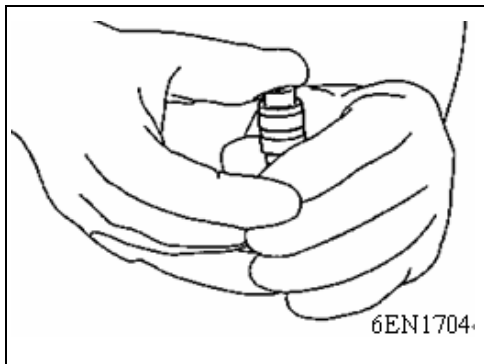
Caution:

Do not clean the hydraulic tappet in container C. If the hydraulic tappet is cleaned in container C, foreign objects may enter the pressure cavity with diesel oil.



(10) Place the hydraulic tappet vertically with its plunger at the top end, and stably move the plunger downward until it reaches its max. travel. Then slowly return the plunger, and release the steel ball to fill the pressure cavity

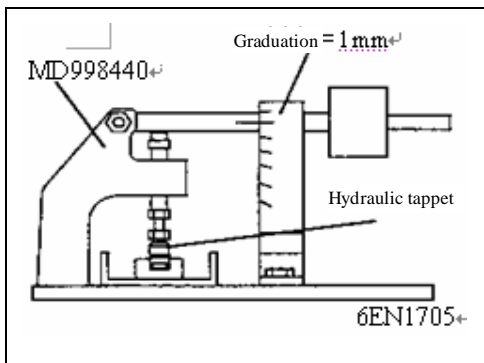
(11) Remove special tool MD998441.



- (12) Take out the hydraulic tappet from the container. Place the hydraulic tappet vertically with its plunger at top end. Stably push the plunger, and check for no movement. Check it and the new hydraulic tappet for their height comparison.

Caution:

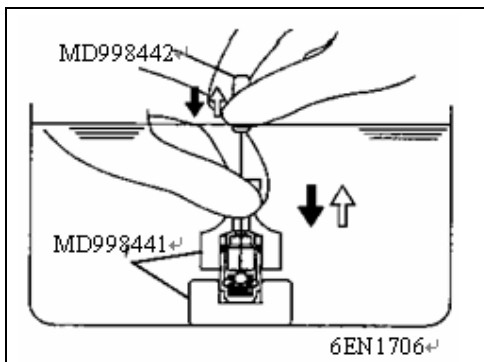
If the hydraulic tappet becomes smaller, repeat Steps (9) to (12) to fill the hydraulic tappet with diesel oil. If it becomes even smaller when these steps are conducted, replace the hydraulic tappet.



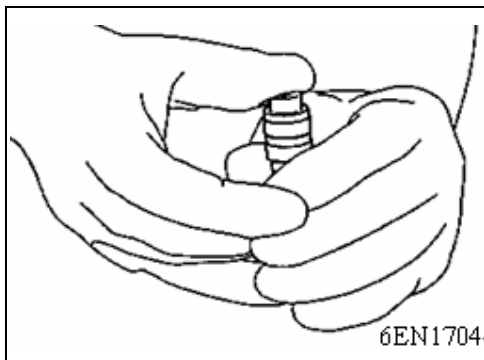
- (13) Install the hydraulic tappet onto the special tool.
 (14) After the plunger drops by 0.2~0.5mm, measure the time required by the plunger to drop by 1mm.

Standard value : 3~20sec/1mm (with diesel oil at 15~20°C)

Caution: Replace the hydraulic tappet if the measured value is not satisfactory.



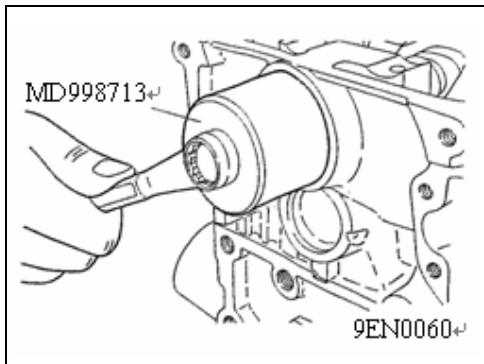
- (15) Install special tool MD998441 on the hydraulic tappet.
 (16) Replace the hydraulic tappet into container C, and then gently push the internal steel ball by using special tools MD998442.
 (17) Place the hydraulic tappet vertically with its plunger at the top end, and stably move the plunger downward until it reaches its max. travel. Then slowly return the plunger, and release the steel ball to fill the pressure cavity with diesel oil.
 (18) Remove special tool MD998441.



- (19) Take out the hydraulic tappet from the container. Place the hydraulic tappet vertically with its plunger at top end. Stably push the plunger, and check for no movement. Check it and the new hydraulic tappet for their height comparison.

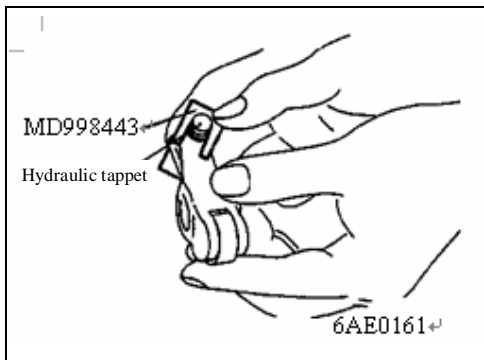
Caution: If the hydraulic tappet becomes smaller, repeat Steps (15) to (19) to fill the hydraulic tappet with diesel oil. If it becomes even smaller when these steps are conducted, replace the hydraulic tappet.

- (20) Hold the hydraulic tappet vertically to prevent the diesel oil from flowing out. Avoid hydraulic tappet from being polluted by dust or foreign object. Install the hydraulic tappet onto the engine as soon as possible.



Notice for Installation

Installation of Seal

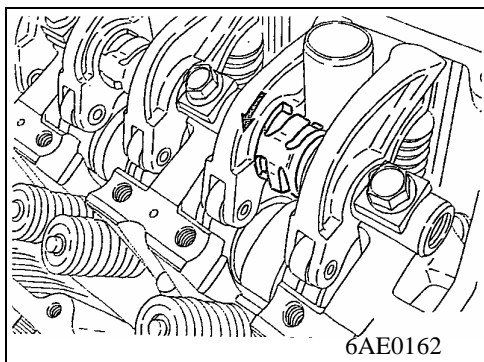


Installation of Hydraulic Tappet

- (1) Insert the hydraulic tappet into the rocker arm, and pay attention not cause the diesel oil to overflow. Then use special tool to prevent it from falling during installation.

Caution:

- The hydraulic tappet must be cleaned if reused.

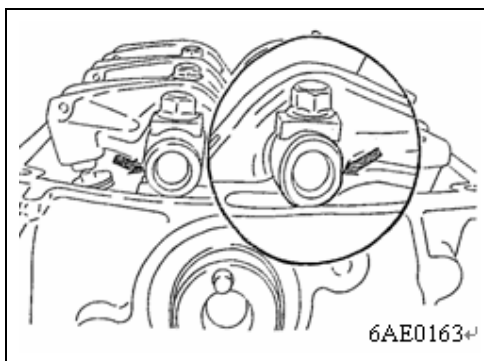


Installation of Rocker Arm Shaft Spring, Rocker Arm and Rocker Arm Shaft

- (1) Temporarily tighten the Intake rocker arm shaft until all the rocker arms do not push the valve.
- (2) Install the rocker arm shaft spring with it vertical to the spark plug pipe.

Note: First install rocker arm shaft spring, and then install the exhaust rocker arm and rocker arm shaft.

- (3) Remove the special tool used for holding the hydraulic tappet.



- (4) Make sure that the notch on rocker arm shaft is positioned as shown in the Fig.